

Conceptual Design for a Detector to Measure Mixing, CP Violation and Rare Decays in Beauty and Charm Particle Decays at the Fermilab Collider - BTeV*

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G.Y. Drobychev, A.S. Lobko, A.R. Lopatik and R.F. Zouevsky

Belarussian State University, National Science and Education Center, 240040, Minsk

P. Yager

University of California at Davis, Exp. High Energy Group, One Shields Ave.,
Davis CA 95616-8677 USA

J. Cumalat, P. Rankin and K. Stenson

University of Colorado, High Energy Physics, Campus Box 390,
Boulder, CO 80309, USA

J. A. Appel, E. Barsotti, C. N. Brown, J. Butler, H. Cheung, D. Christian,

S. Cihangir, M. Fischler, I. Gaines, P. Garbincius, L. Garren, E. E. Gottschalk,

A. Hahn, G. Jackson, P. Kasper, P. H. Kasper, R. Kutschke, S. W. Kwan, P. Lebrun,

P. McBride, J. Slaughter, M. Votava, M. Wang, and J. Yarba

Fermilab, PO Box 500, Batavia, IL 60510, USA

P. Avery

University of Florida, Gainesville, FL 32611, USA

A. Daniel, K. Lau, M. Ispiryan, B.W. Mayes, V. Rodriguez, and S. Subramania, and G. Xu

University of Houston, Houston, TX 77204-5506, USA

R.A. Burnstein, D.M. Kaplan, L.M. Lederman, H.A. Rubin, and C. White

Illinois Institute of Technology, Chicago, IL 60616, USA

M. Haney, D. Kim, M. Selen, V. Simaitis, and J. Wiss

University of Illinois at Urbana-Champaign, High Energy Physics,
441 Loomis Lab. of Physics, 1110 W. Green St., Urbana, IL 61801-3080, USA

M. Bertani, L. Benussi, S. Bianco, M.A. Caponero, F. Fabbri, A. Felli, M. Giardoni,

A. LaMonaca, E. Pace, M. Pallotta and A. Paolozzi

INFN - Laboratori Nazionali di Frascati, CP 13, via E. Fermi 40,
1-00044, Frascati, Roma, Italy

G. Alimonti, M. Dinardo, L. Edera, S. Erba, D. Lunesu, S. Magni, D. Menasce,

L. Moroni, D. Pedrini, S. Sala and L. Uplegger

INFN and University of Milano, Italy

G. Boca, G. Cossali, G. Liguori, F. Manfredi, M. Manghisoni, M. Marengo, L. Ratti,

V. Re, M. Santini, V. Speziali, P. Torre, and G. Traversi

INFN - Pavia, Dipartimento di Fisica Nucleare e Teorica, Universita' di Pavia,

*Spokespersons: Joel Butler and Sheldon Stone

Sez. di Pavia, Italy

A. A. Derevschikov, Y. M. Goncharenko, V. Yu. Khodyrev, V. Kravtsov, A. P. Meschanin,
V. Mochalov, D. Morozov, L. V. Nogach, P. Semenov, K. E. Shestermanov, L. F. Soloviev,
A. Uzunian and A. N. Vasiliev
Institute of High Energy Physics (IHEP), Protvino, Moscow Region, Russia

P. Ratcliffe and M. Rovere
University of Insubria in Como

C. Newsom and R. Braunger
The University of Iowa, Department of Physics & Astronomy,
Iowa City, IA 52242-1479

J. Hietala, Y. Kubota, B. Lang, R. Poling, and A. Smith
University of Minnesota, High Energy Physics, Tate Laboratory of Physics,
116 Church St. S.E., Minneapolis, MN 55455, USA

T. Y. Chen, D. Gao, S. Du, Ming Qi, B.P. Zhang, Z. Xi Zhang, and J.W. Zhao
Nanjing University, Dept. of Physics, Nanjing 210008, China

V. Papavassiliou
New Mexico State University

J. Rosen
Northwestern University, Dept. of Physics, Evanston, IL 60208

K. Honscheid, and H. Kagan
Ohio State University, HEP Group, Dept. of Experimental or Theoretical Physics,
Smith Lab, 174 W. 18th Ave., Columbus, OH 43210, USA

W. Selove
University of Pennsylvania, Philadelphia, PA 19104, USA

A. Lopez, H. Mendez, W. Ramirez, and W. Xiong
University of Puerto Rico, Mayaguez, Puerto Rico

G. Datao, L. Hao, Ge Jin, T. Yang and X.Q. Yu
University of Science and Technology of China, Department of Modern Physics,
Joint Institute for High Energy Physics, Hefei, Anhui 230027, China

C.F. Feng, Yu Fu, Mao He, J.Y. Li, L. Xue, N. Zhang, and X. Y. Zhang
Shandong University, High Energy Physics Group; Jinan, Shandong 250100, China

T. Coan and M. Hosack
Southern Methodist University, Dallas, TX 75275, USA

M. Artuso, S. Blusk, J. Butt., C. Boulahouache, O. Dorjkhaidav, J. Haynes,
N. Menaa, R. Mountain, R. Nandakumar, L. Redjimi, R. Sia, T. Skwarnicki
S. Stone, J. C. Wang, and K. Zhang
Syracuse University, 201 Physics Bldg., Syracuse, NY 13244-1130, USA

T. Handler and R. Mitchell
University of Tennessee, Knoxville, TN 37996-1200, USA

W. Johns, P. Sheldon, E. Vaandering, and M. Webster
Vanderbilt University, Department of Physics and Astronomy,
Nashville, TN 37235, USA

M. Arenton, S. Conetti, B. Cox, and A. Ledovskoy, H. Powell, M. Ronquest,
D. Smith, B. Stephens and Z. Zhe

University of Virginia, High Energy Physics Group, Charlottesville, VA 22901, USA

G. Bonvicini, D. Cinabro, and A. Schreiner

Wayne State University, Department of Physics and Astronomy,
666 W. Hancock, Detroit, MI 48202, USA

M. Sheaff

University of Wisconsin, Phenomenology Inst., Dept. of Physics,
1150 University Ave., Madison, WI 53706, USA

S. Menary

York University, Dept. of Physics
4700 Keele St., Toronto, ON M3J 1P3, Canada

The BTeV Conceptual Design Report

This report is substantially the same as the “BTeV Proposal Update”, submitted to Fermilab in May of 2002. This “Update” represented a descoping of the original BTeV proposal, submitted to Fermilab in May of 2000 after many years of discussion, preparation, and interaction with the Fermilab management and with the Fermilab Program Advisory Committee (PAC). Fermilab approved the original proposal at the end of June 2000. The purpose of the descoping in 2002 was to reduce the cost of the experiment, which was considered to be an issue by the HEPAP Subpanel on Long Range Planning. To save money the detector has only one arm as compared to two in the original proposal.

In the year that has passed since the “Update” was written, Fermilab has conducted a technical and cost review of BTeV (October 2002), R&D has continued, the physics case has continued to be developed, an effort to prepare a complete resource loaded cost and schedule is underway, and many technical designs have advanced to a new level of detail. The group is preparing to incorporate all the recent progress in a “Technical Design Report (TDR)”. However, the “Update” continues to provide the complete conceptual design for proposed detector except in three respects:

- the mechanical support and cooling of the silicon pixel detector. The technical design has changed significantly in the last year due to concerns raised in the October 2002 review;
- the cost estimate was also reviewed by Fermilab in the October 2002 review. The new estimate, which is only about 7% higher than the original, reflects fully the findings and recommendations of the committee; and
- the physics case has changed with the input of more theoretical ideas and also new data from the e^+e^- B -factories. Most of this new material is contained in our answer to one of the questions of the P5 HEPAP subpanel and can be found at <http://www-btev.fnal.gov/cgi-bin/DocDB/ShowDocument?docid=1618> . Some material in the Physics Case chapter has been updated as well.

The physics sensitivities were updated in May 2002 to reflect the single arm configuration. Comparisons with other experiments reflect their calculations at the time. Since then, LHCb has undergone a massive redesign and their latest sensitivities are only now beginning to appear. We also have been told that the Tevatron will now run at a bunch separation of 396 ns rather than 132 ns. A recent set of calculations demonstrate that this changes BTeV’s sensitivities in a mode dependent manner, up to 15% in the number of signal events in the worst case.

Despite the obviously fluid situation, the BTeV design has changed little from the “Update” except for the items mentioned above. The pixel description in the CDR is the same as the one appearing in the “Update” and does not reflect the recent changes to the design. The CDR does include the updated cost estimate for the one-arm system based on input from the October 2002 review. The revised mechanical and cooling system for the Pixel

detector and the most recent cost estimates, which were undertaken at the end of 2003 and show no significant change in the total cost, will be presented in the TDR.